Biological Results of the Strait of Georgia Spiny Dogfish (*Squalus Acanthias*) Longline Survey October 18-31, 2005

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BIOLOGICAL RESULTS OF THE STRAIT OF GEORGIA SPINY DOGFISH (*Squalus Acanthias*) LONGLINE SURVEY OCTOBER 18-31, 2005

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ABSTRACT

McFarlane, G.A., King, J. R, and Hodes, V.R. 2006. Biological results of the Strait of Georgia Spiny Dogfish (*Squalus Acanthias*) longline survey October 18-31, 2005. Can. Data Rep. Fish. Aquat. Sci. 1182: iii + 24 p.

From October 18 to 31, 2005, a spiny dogfish (*Squalus acanthias*) longline survey was conducted in the Strait of Georgia aboard the *CCGS Neocaligus*. Fishing occurred at ten sites selected to be representative of commercial fishing areas: Active Pass, Porlier Pass, Sturgeon Bank, French Creek, Hornby Island, Cape Lazo, Cape Mudge, Grants Reef, Sinclair Bank and Epson Point. Four main depth strata were fished during this survey: 56 to 110m, 111 to 165m, 166 to 220m and deeper than 220m. All captured spiny dogfish were measured for length and sex. Second dorsal spines were removed for age estimation from size selected male dogfish and site specific female dogfish. Maturity condition was collected from a random subsample of male dogfish as well as all dogfish from which spines were collected. CPUE varied by depth strata.

RÉSUMÉ

McFarlane, G.A., King, J. R, and Hodes, V.R. 2006. Biological results of the Strait of Georgia Spiny Dogfish (*Squalus Acanthias*) longline survey October 18-31, 2005. Can. Data Rep. Fish. Aquat. Sci. 1182: iii + 24 p.

Du 18 au 31 octobre 2005, le *NGCC Neocaligus* a effectué un relevé à la palangre de l'aiguillat commun (*Squalus acanthias*) dans le détroit de Georgie. La pêche s'est déroulée à dix sites sélectionnés comme étant représentatifs des zones de pêche commerciale : passage Active, passage Porlier, banc Sturgeon, ruisseau French, île Hornby, cap Lazo, cap Mudge, récif Grants, banc Sinclair et pointe Epson. Durant ce relevé, la pêche a été pratiquée à quatre strates de profondeur principales, soit de 56 à 110 m, de 111 à 165 m, de 166 à 220 m et à plus de 220 m. Nous avons mesuré la longueur de tous les aiguillats capturés et nous en avons déterminé le sexe. Nous avons prélevé la deuxième épine dorsale de mâles choisis en fonction de leur taille et de femelles particulières au site aux fins d'estimation de l'âge des poissons. Nous avons déterminé l'état de maturité à partir d'un sous-échantillon aléatoire de mâles et des aiguillats dont nous avons prélevé la deuxième épine dorsale. Les prises par unité d'effort (PUE) ont varié en fonction de la strate de profondeur.

INTRODUCTION

Spiny dogfish (*Squalus acanthias*) were an important component of Canada's Pacific fishery from the late 1800s to the mid 1950s (Ketchen 1986). A resurgence in interest in the fishery led to an increase in catches in the late 1970s, particularly in the Strait of Georgia. Based on tagging studies (McFarlane and King 2002), the Strait of Georgia stock is considered to be discreet. The increase in fishing catches in the late 1970s prompted the initiation of an assessment program. As part of this study, longline surveys were conducted in the Strait of Georgia in 1986 and 1989 (McFarlane et al 2005) to provide baseline biological, catch and effort data for selected sites. This report provides catch and biological summary data for a third survey conducted in the Strait of Georgia from October 18 to 31, 2005. It is our intention to continue these surveys on a tri annual basis in order to monitor the status of spiny dogfish in the Strait of Georgia.

METHODS

From October 18 to 31, 2005 the spiny dogfish longline survey was conducted onboard the *CCGS Neocaligus*.

Longline fishing occurred at ten sites throughout the Strait of Georgia (Figure 1) selected to be representative of commercial fishing areas which were surveyed in the 1986 and 1989 surveys. Initial survey design had longline gear set within 5 depth strata at each of the sample sites. However, time restraints required the curtailing of fishing effort and for all sample sites only 4 of the 5 depth strata could be fished. The sites were located near Active Pass, Porlier Pass, Sturgeon Bank, French Creek, Hornby Island, Cape Lazo, Cape Mudge, Grants Reef, Sinclair Bank and Epson Point (see appendix 1 for positional data). At each site, depth strata 2 to 5 were fished in random order with the exception of Hornby Island where depth strata 1 to 4 were fished. The depth strata fished were the following:

1. 0 to 55m,
2. 56 to 110m,
3. 111 to 165m,
4. 166 to 220m and
5. deeper than 220m.

Once the vessel arrived at the pre-selected site the appropriate depth range was located and fishing proceeded along the depth contour.

All fishing gear and bait was provided by Fisheries and Oceans Canada. Each longline set consisted of 2 groundlines (5/16 inch leaded copolym) with an anchored buoyline (3/8 inch polysteel) hooked on at each end. Model 72 snaps (3 cm in width; 13 cm in length), made from 3.2 mm stainless steel wire, were snapped onto the groundline every 2 meters as the gear was set. Attached to the snap, crimped Perlon snap gangions 30 cm long were fitted with circle hooks. Size #14/0 Mustad circle hooks were used. Each hook was baited with a third of a 6 inch herring.

For Hornby Island, Grants reef, Epson point, Cape Lazo and Sinclair bank each groundline was deployed with 500 baited hooks per set. At Porlier pass, Active Pass, Sturgeon Bank and French Creek, 400 baited hooks were set per depth stratum. Hook number was reduced due to high catch rates at the initial sites.

The effective fishing time for each set was recorded as the time from when the first hook was deployed until the main groundline anchor was onboard. In order to minimize bias in catch rates due to differences in effective fishing time, all longline sets were fished for approximately 2 hours. Catch per unit effort (CPUE) for a longline set was calculated as the total number of spiny dogfish caught per thousand hooks.

All fish, other than those lost at the surface, were removed from the hooks, identified to species and counted. All dogfish lost at surface were noted and included in the total catch numbers. All spiny dogfish brought on board were retained for sampling; other species were identified and immediately released.

Length and sex were recorded from all captured spiny dogfish. Sex was determined externally for both male and female dogfish. Maturity was determined for a random subsample of male dogfish and from all dogfish for which spines were collected for ageing. Maturity was determined internally for females, externally for males. Maturity stages are described in Appendix 2. Briefly, the female maturity has two stages, one describing the condition of the ovary and a second describing the condition of the uteri. Males were grouped into 3 categories; immature, maturing and mature. Females were grouped into 16 categories with 4 for immature fish, 6 for maturing and 6 for mature fish.

Second dorsal spines were removed for ageing (Beamish and McFarlane 1985) and stored individually in pre-numbered envelopes. Spines were frozen onboard, to be later thawed, air dried and stored. Length was measured (mm) as the total length of the fish; from the tip of the snout to the tip of the upper lobe of the caudal fin when it was directed downward in a straight line with the body.

BIOLOGICAL RESULTS

From October 18-31, 2005, 18,201 hooks were set over 40 sets at 10 sites: 4 sets were made at each of the following sites: Active Pass; Porlier Pass; Sturgeon Bank; French Creek; Hornby Island; Cape Lazo; Cape Mudge; Grants Reef ; Sinclair Bank and Epson Point (Figure 1). Mean effective fishing time was 126 minutes per set. A total of 11014 spiny dogfish were sampled, of which 3303 were female and 7711 were male. Quillback rockfish (*Sebastes maliger*), Longnose skate (*Raja rhina*) and Yelloweye rockfish (*S. ruberrimus*) were the most frequent bycatch encountered (Table 1).

CATCH PER UNIT EFFORT

The mean CPUE for spiny dogfish was 605 fish/1000 hooks. CPUE by site ranged from 448 to 754 fish/1000 hooks. For male spiny dogfish the mean CPUE by site was 433 fish/1000 hooks; for female spiny dogfish it was 176 fish/1000 hooks (Table 2). Sites with the highest dogfish CPUE were Porlier Pass, Active Pass and Sturgeon Bank. French Creek and Hornby Island sites had the lowest CPUE. Female spiny dogfish CPUE was highest at Sinclair Bank and Epson Point; male spiny dogfish CPUE was highest at Sturgeon Bank and Porlier Pass (Table 2). CPUE varied by depth (Table 3, Figure 2). For males, the CPUE increased by depth through stratum 1 to 3 then decreased in depth strata 4 and 5. For females, the CPUE was highest in depth stratum 4 and 5 then decreased in depth strata 3 and 2 (Table 3, Figure 2).

LENGTH FREQUENCY

Length and sex was recorded for the 11,014 dogfish brought onboard. Detailed spiny dogfish length frequency catch data for sex by fishing site and sex by depth strata is presented in Tables 4 and 5 and Figures 3 and 4.

A total of 3303 females and 7711 males were measured (Table 5). Male spiny dogfish ranged in size from 462-1025 mm with a mean length of 747 cm (Table 4). Female spiny dogfish ranged in size from 474-1177 mm with a mean length of 725 mm (Table 4). Mean female and male dogfish size decreased with increasing depth. The mean length for male dogfish was greater than that of female dogfish in depth stratum 1 (no females caught), 3, 4 and 5. In depth stratum 2, mean female length was greater than male. The smallest spiny dogfish was male, 462 mm, and caught in depth stratum 4; the largest was female, 1177 mm, also caught in depth stratum 4 (Table 4).

By depth and area, the size range for female spiny dogfish was more varied than the size range of male spiny dogfish (Figure 3 and 4).

SEX DISTRIBUTION BY DEPTH STRATA AND SITE

Depth strata

For all sites combined in the Strait of Georgia, there was a larger proportion of male spiny dogfish caught in each depth strata (Table 3). Only male dogfish were caught in the shallowest depth strata with female dogfish present in increasing proportion by depth (Figure 5).

Site

Seven of the ten sites had a larger proportion of male spiny dogfish ranging from 61% to 92% of the catch. At the remaining three sites, Epson Point, French Creek and Sinclair Bank, female spiny dogfish proportion ranged from 58% to 81% of the catch (Figure 6).

MATURITY

Maturity condition was assessed for site specific female and size selected male spiny dogfish as well as from a random selection of male dogfish (full description of maturity condition in Appendix 1).

Female spiny dogfish maturity

Of the female dogfish sampled, 85.3% were immature; 5.5% were maturing; and 9.1% were mature (Table 6). Immature female dogfish were the most abundant in all depth strata. (Table 7a). Varying by depth, immature female spiny dogfish ranged from 48.2-93.4% of female dogfish sampled, maturing female dogfish ranged from 2.2-14.9% and mature female dogfish ranged from 4.4-36.8% of sampled female catch (Table 7a).

The largest proportion of immature females occurred in depth stratum 5. The smallest proportion of immature female spiny dogfish occurred in depth stratum 1. The largest proportion of maturing females occurred in depth stratum 2. The smallest proportion of maturing female dogfish occurred in depth stratum 5. The largest proportion of mature female dogfish occurred in depth stratum 2 and the smallest proportion of mature female dogfish occurred in depth stratum 5 (Table 7a).

Male spiny dogfish maturity

Of all male spiny dogfish sampled, 83.6% were mature; 4.6% maturing; and 11.8% immature (Table 6). In all depth strata mature male dogfish were the most abundant. Varying by depth mature male spiny dogfish ranged from 61.8-96.7% of male dogfish catch, maturing male dogfish ranged from 1.9-10.6% and immature male dogfish ranged from 0.8-27.6% of sampled male catch (Table 7b).

The largest proportion of immature male dogfish occurred in depth stratum 5. The smallest proportion of immature male dogfish occurred in depth stratum 1 (Table 7b). The

largest proportion of maturing male dogfish occurred in depth stratum 5. The smallest proportions of maturing male dogfish occurred in depth stratum 3 and 4. The largest proportion of mature male dogfish occurred in depth stratum 1. The smallest proportion of mature male dogfish occurred in depth stratum 5.

DISCUSSION

This is the third longline survey (McFarlane et al 2005) conducted in the Strait of Georgia designed to monitor the status, and collect biological samples of spiny dogfish. The information from these surveys will provide the basis for examining current and future spiny dogfish dynamics and abundance trends in the Strait of Georgia.

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Table 1. Number of fish caught by species during the October 2005 spiny dogfish longline survey. Recorded species include: Spiny dogfish (*Squalus acanthias*), Quillback rockfish (*Sebastes maliger*), Copper rockfish (*S. caurinus*), Halibut (*Hippoglossus stenolepis*) Lingcod (*Ophiodon elongates*), Longnose skate (*Raja rhina*), Big skate (*R. binoculata*)), Greenstripe rockfish (*S. elongates*), Yelloweye rockfish (*S. ruberrimus*), Pacific tomcod (*Microgadus proximus*), Pacific cod (*Gadus macrocephelus*), Pacific sanddab (*Citharichthys sordidus*), and Ratfish (*Hydrolagus colliei*). A total of 11207 spiny dogfish were hooked; 193 were lost at surface; 11,014 were sampled.

Set	Spiny Dogfish	Quillback Rockfish	Copper Rockfish	Pacific Halibut	Lingcod	Longnose Skate	Big Skate	Greenstripe	Yelloweye Rockfish	Tom Cod	Pacific Cod	Pacific Sanddab	Ratfish
1	219	..	..	..	..	..	..	..	..	..	..	..	..
2	325	..	..	..	..	1	..	..	..	..	..	..	..
3	259	..	..	..	..	..	..	..	..	..	..	..	..
4	121	14	3	..	14	3	1	..	1	..	..	..	..
5	346	..	..	..	..	..	..	..	..	..	..	..	..
6	395	..	..	..	..	..	..	..	..	..	..	..	..
7	333	..	..	..	..	1	..	..	..	..	..	..	..
8	287	6	2	1	..	2	..	1	..	..	..	..	..
9	323	..	..	..	..	..	..	..	..	..	..	..	..
10	368	..	..	..	..	..	..	..	1	..	..	..	..
11	370	..	..	..	..	..	..	..	..	..	..	..	..
12	110	11	..	..	..	2	..	2	4	..	..	..	..
13	363	..	..	..	..	..	..	..	..	..	..	..	..
14	366	..	..	..	..	..	..	..	5	..	..	..	..
15	206	3	5	4	..	2	3	..	1	..	1	3	3
16	340	..	..	..	..	..	..	..	..	..	..	..	..
17	91	1	..	..	..	..	..	..	1	..	..	..	1
18	278	1	..	..	..	4	..	1	1	..	..	..	..
19	360	..	..	..	..	..	..	..	..	..	..	..	..
20	315	..	..	..	..	3	..	..	8	..	1	..	..
21	409	..	..	..	..	2	..	..	..	..	..	..	..
22	362	..	..	..	..	1	..	..	..	..	1	..	..
23	6	2	..	..	..	..	..	1	..	..	..	..	..
24	386	..	..	..	..	..	..	..	..	..	..	..	..
25	318	..	..	..	..	1	..	..	..	..	..	..	..
26	346	..	..	..	..	..	..	..	..	..	..	..	..
27	295	..	..	..	..	1	..	..	..	..	..	..	..
28	265	..	..	..	..	..	..	..	..	..	..	..	..
29	303	..	..	..	..	..	..	..	..	..	..	..	..
30	297	..	..	..	..	..	..	..	..	..	..	..	..
31	311	..	..	..	..	2	..	..	1	..	..	..	..
32	238	..	..	..	..	1	..	..	..	..	..	..	..
33	225	..	..	..	..	..	..	..	..	..	..	..	..
34	316	..	..	..	..	..	..	..	..	..	..	..	..
35	320	..	..	..	..	1	..	..	..	..	..	..	..
36	293	..	..	..	..	..	..	..	..	..	..	..	..
37	85	..	1	..	..	1	..	..	..	4	1	2	..
38	272	..	..	..	..	9	..	..	..	..	..	..	..
39	294	..	..	..	..	..	..	..	..	..	..	..	..
40	91	..	..	..	..	..	1	..	2	..	..	..	3
Total:	11207	38	11	5	14	37	5	5	25	4	4	5	7

Table 2. Summary by fishing area of number of sets, mean effective fishing time, number of hooks deployed, number of measured spiny dogfish, CPUE (fish per 1000 hooks) and mean length (mm) from the October 18 to 31, 2005 Strait of Georgia spiny dogfish longline survey.

Location	Number of sets	Mean effective fishing time	Number of Hooks	Number of Dogfish	CPUE			Mean Length		
					Male	Female	Total	Male	Female	Total
Active Pass	4	125	1585	1131	574	140	714	759	678	743
Epson Point	4	124	2000	1143	148	424	572	721	757	748
French Creek	4	131	1600	717	191	258	448	722	830	784
Grants Reef	4	125	1987	1150	354	225	579	728	697	716
Hornby Island	4	125	1829	921	471	32	504	772	663	765
Cape Laxo	4	129	2000	1349	626	49	675	773	623	762
Cape Mudge	4	125	2000	1239	512	108	620	733	656	720
Porlier Pass	4	125	1600	1206	664	90	754	718	690	715
Sinclair Bank	4	122	2000	1026	98	416	513	644	714	701
Sturgeon Bank	4	129	1600	1132	690	18	708	770	588	765
	Total:		18201	11014	Overall CPUE		605			

Table 3. Summary of CPUE (fish /1000 hooks), mean effective fishing time (minutes) and mean total length (mm) by depth stratum from the October 18-31, 2005 Strait of Georgia spiny dogfish longline survey.

Depth Stratum	Depth Range	Number of sets	Mean effective fishing time	Number of hooks	Number of dogfish	Number of females	Number of males	CPUE		
								Total	Female	Male
1	0-55	1	121	500	121	0	121	242	0	242
2	56-110	10	124	4580	1733	249	1484	378	54	324
3	111-165	10	127	4549	3033	873	2160	667	192	475
4	166-220	10	127	4495	3192	1114	2078	710	248	462
5	>221	9	126	4077	2935	1067	1868	720	262	458

Table 4. Summary (mean, minimum, maximum) of total length (mm) data for spiny dogfish captured by depth stratum.

Depth Stratum	Male spiny dogfish			Female spiny dogfish			All spiny dogfish		
	mean	min	max	mean	min	max	mean	min	max
1	793	704	921	0	0	0	793	704	921
2	769	532	1025	830	522	1096	777	522	1096
3	744	479	951	734	474	1084	741	474	1084
4	740	462	972	720	485	1177	733	462	1177
5	737	480	939	700	486	1077	724	480	1077

Table 5. Spiny dogfish length frequency data from the spiny dogfish longline survey conducted in the Straight of Georgia onboard *C/V Neocaligus*, October 18-31, 2005.

Length interval (mm)	Number of males	Number of females
450-500	6	3
500-550	52	75
550-599	228	346
600-649	452	532
650-699	821	557
700-749	2100	529
750-799	2427	397
800-849	1195	305
850-899	376	283
900-949	48	175
950-999	5	63
1000-1049	1	30
1050-1099	0	7
1100-1149	0	0
1150-1200	0	1
Total:	7711	3303

Table 6. Observed maturity stages of male and female spiny dogfish sampled in October 18-31 2005. Detailed description of maturity codes are found in Appendix 1.

Sex	Maturity State	Maturity Code	Number of Dogfish	Proportion of total sample (%)
Male	Immature	10	162	11.8
	Maturing	30	64	4.6
	Mature	90	1152	83.6
Female	Immature	10	546	48.8
		50	234	20.9
		51	140	12.5
		53	34	3.0
	Total Immature:		954	85.3
	Maturing	55	8	0.7
		56	38	3.4
		70	6	0.5
		71	6	0.5
		73	2	0.2
		75	2	0.2
	Total Maturing:		62	5.5
	Mature	77	39	3.5
		78	12	1.1
		95	2	0.2
		97	39	3.5
		99	10	0.9
	Total Mature:		102	9.1

Table 7a. Female spiny dogfish maturity by depth stratum.

Depth stratum	Number of immature dogfish	% by depth strata	Number of maturing dogfish	% by depth strata	Number of mature dogfish	% by depth strata	Total sampled female dogfish
2	55	48.2	17	14.912	42	36.8	114
3	263	84.3	21	6.731	28	9.0	312
4	337	90.6	17	4.570	18	4.8	372
5	299	93.4	7	2.188	14	4.4	320
total:	954	85.3	62	5.546	102	9.1	1118

Table 7b. Male spiny dogfish maturity by depth stratum.

Depth stratum	Number of immature dogfish	% by depth strata	Number of maturing dogfish	% by depth strata	Number of mature dogfish	% by depth strata	Total sampled male dogfish
1	1	0.8	3	2.5	117	96.7	121
2	3	1.0	8	2.8	275	96.2	286
3	31	8.6	7	1.9	322	89.4	360
4	17	8.0	4	1.9	192	90.1	213
5	110	27.6	42	10.6	246	61.8	398
total:	162	11.8	64	4.6	1152	83.6	1378

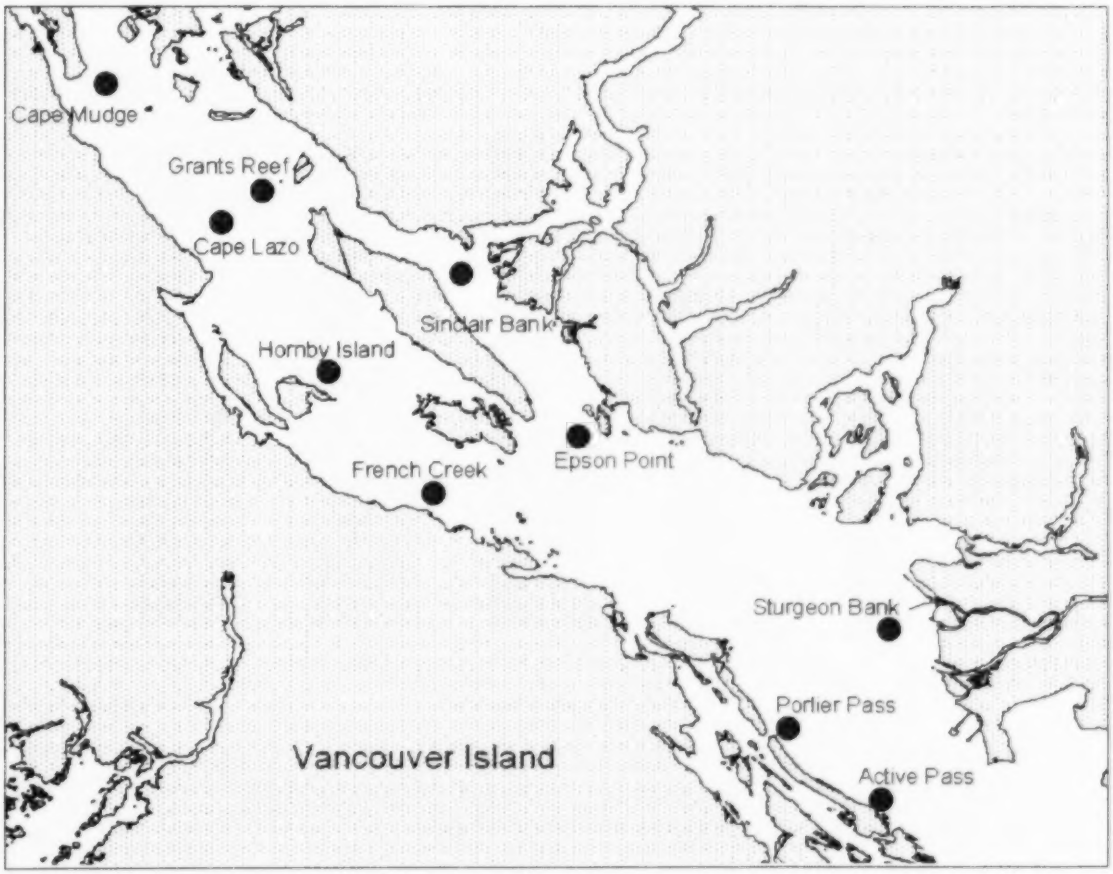


Figure 1. Set locations from the Strait of Georgia spiny dogfish longline survey conducted October 18-31, 2005. For detailed positional information see Appendix 2.

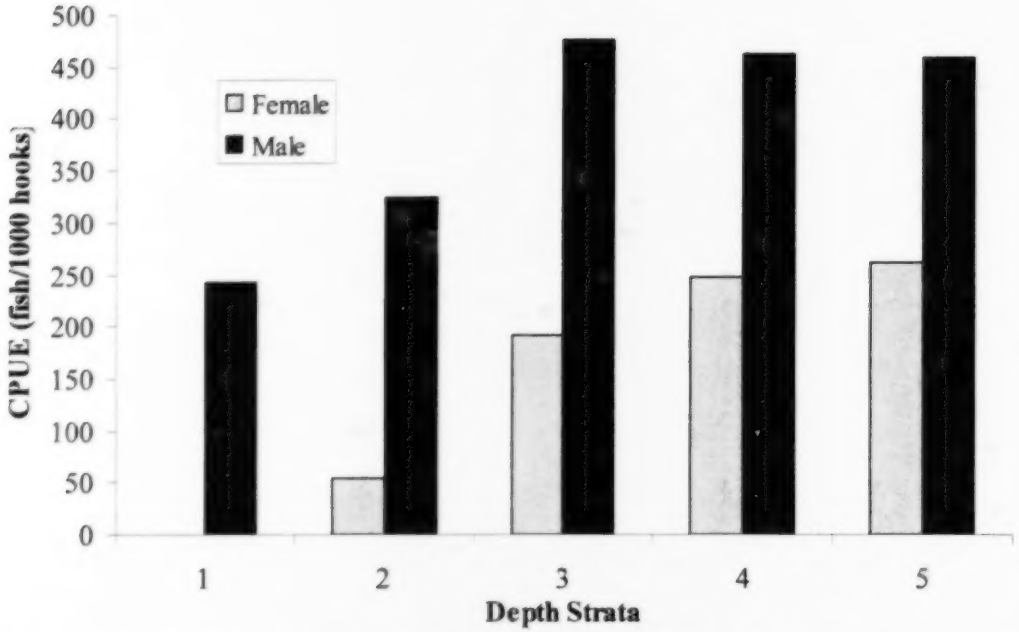
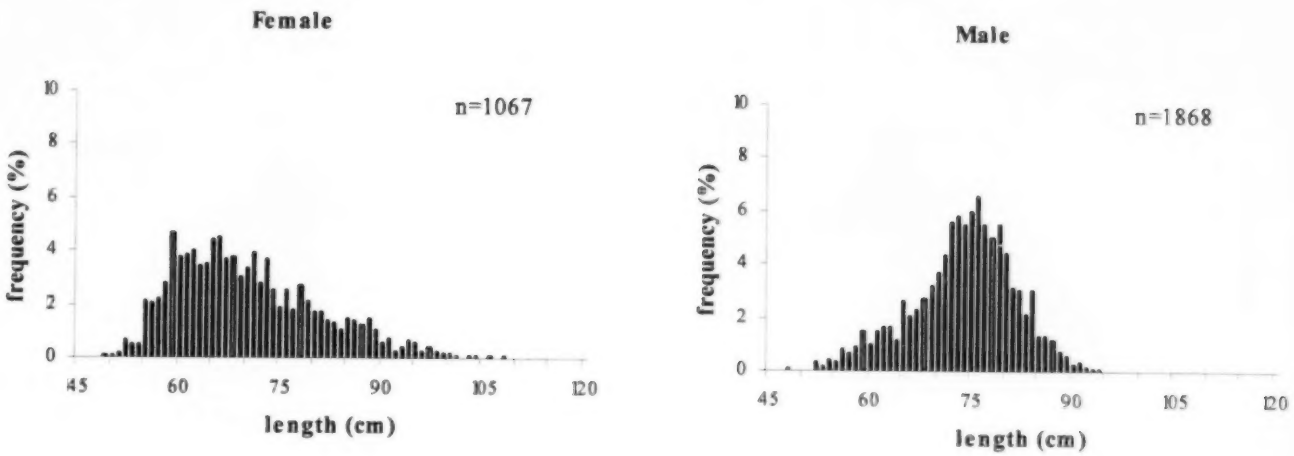


Figure 2. Spiny dogfish catch per unit effort (CPUE, fish/1000 hooks) by depth stratum (1: 0 to 55m, 2: 56 to 110m, 3: 111 to 165m, 4: 166 to 220m and 5: deeper than 220m) from the Strait of Georgia spiny dogfish hook and line survey conducted October 18-31, 2005.

Depth Stratum 5



Depth Stratum 4

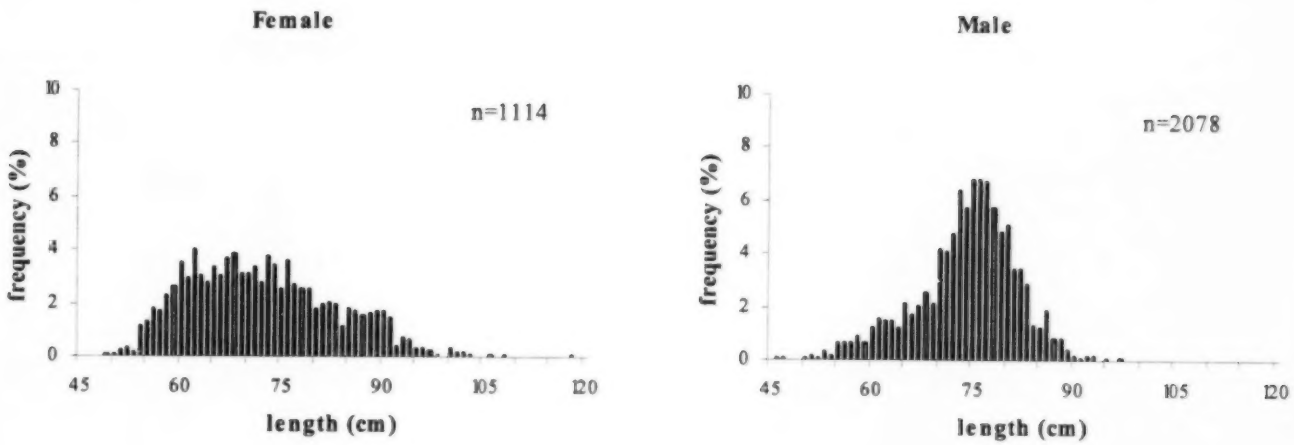
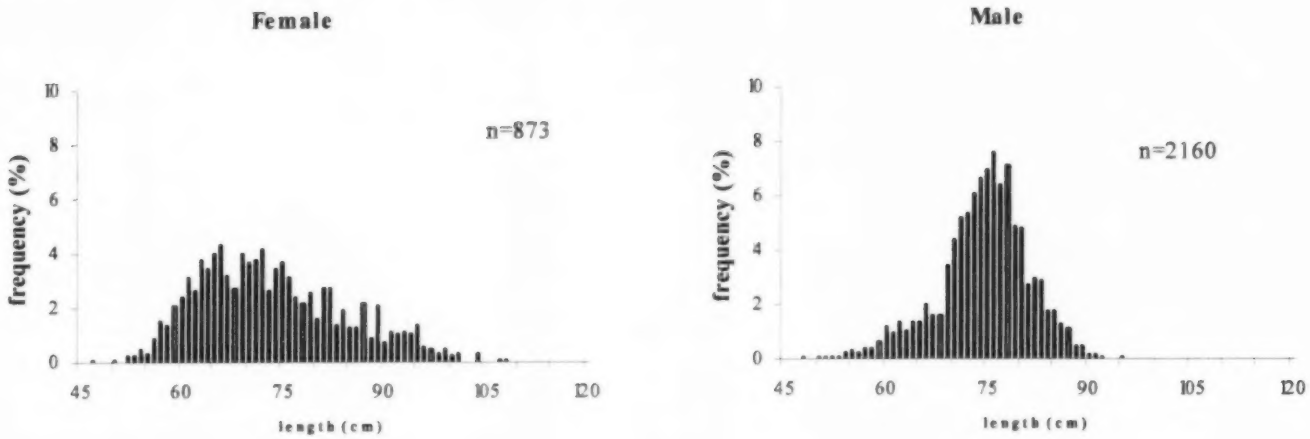


Figure 3. Spiny dogfish length frequency by depth stratum (2: 56 to 110m, 3: 111 to 165m, 4: 166 to 220m and 5: deeper than 220m) from the Strait of Georgia October 18-31, 2005 longline survey.



Depth Stratum 3

Depth Stratum 2

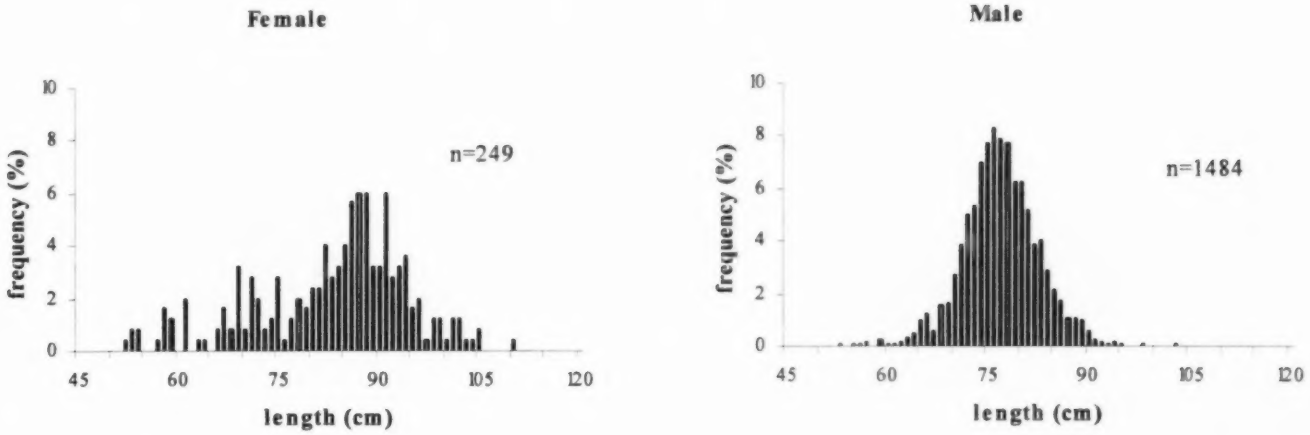
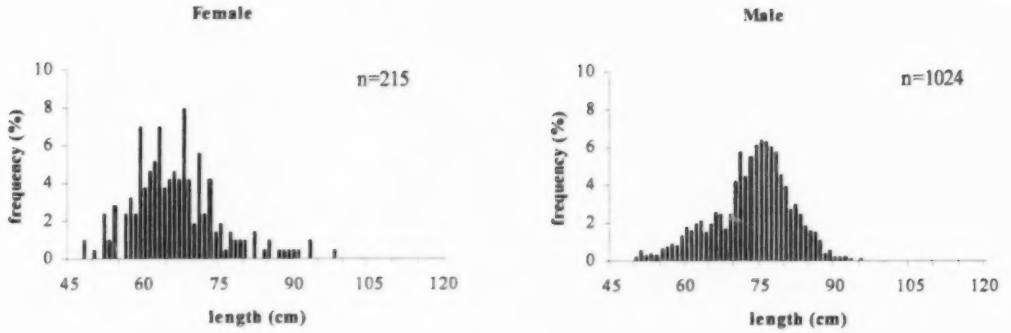
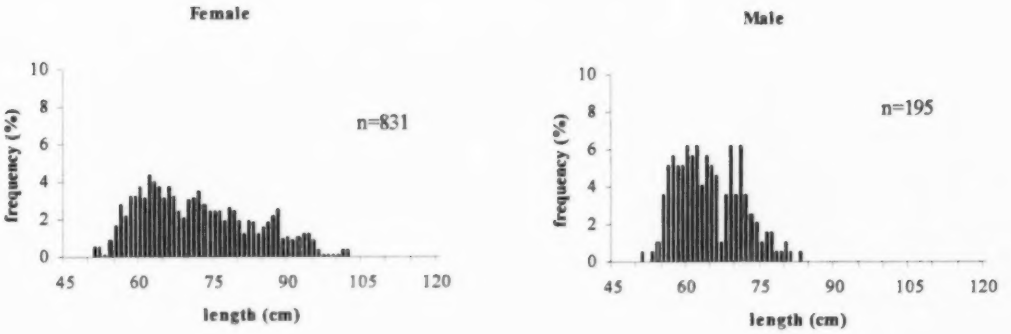


Figure 3 continued. Spiny dogfish length frequency by depth stratum.

Cape Mudge



Sinclair Bank



Hornby Island

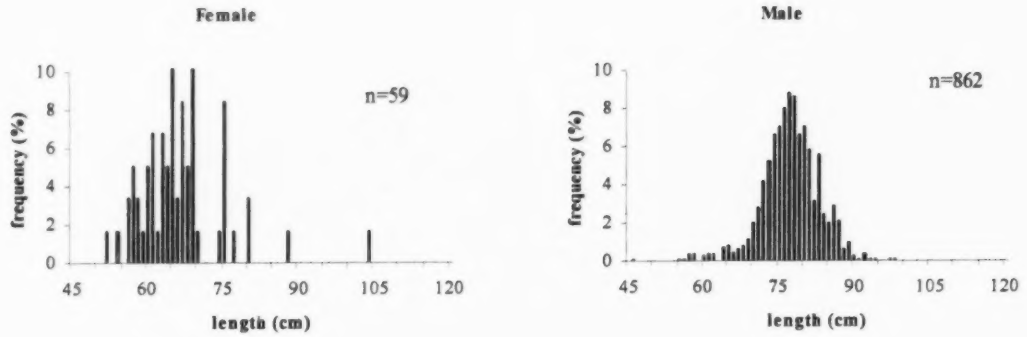
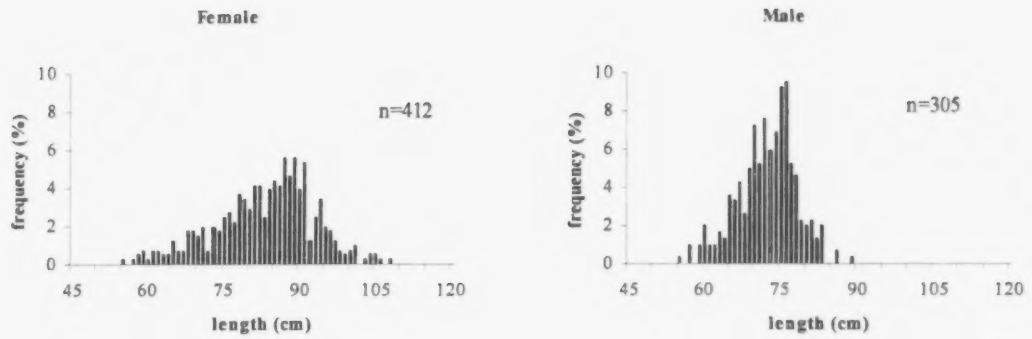
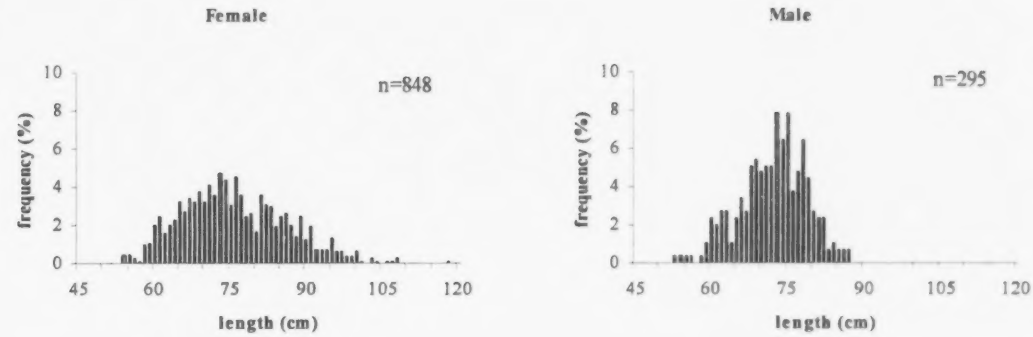


Figure 4. Spiny dogfish length frequency by area from the Strait of Georgia October 18-31, 2005 longline survey.

French Creek



Epson Point



Cape Lazo

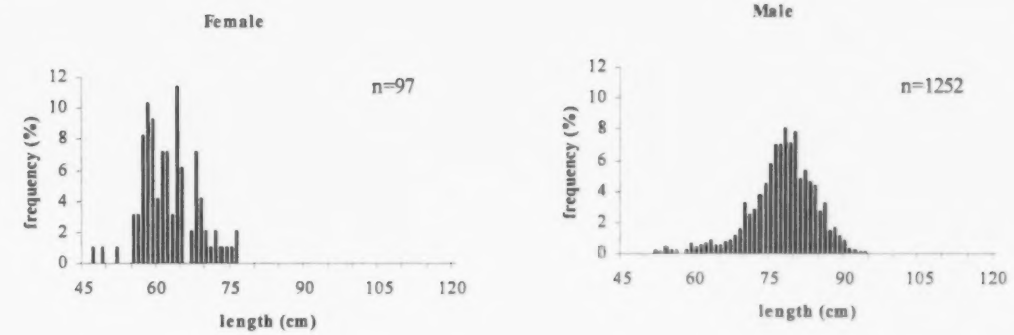
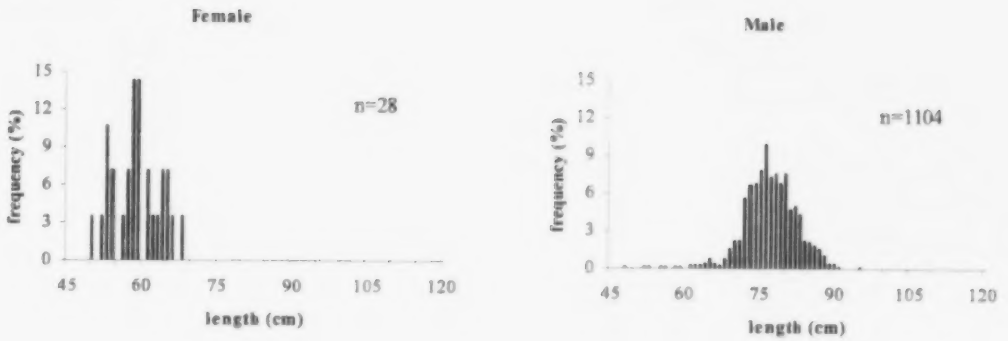


Figure 4 continued. Spiny dogfish length frequency by area from the Strait of Georgia October 18-31, 2005 longline survey.

Sturgeon Bank



Active Pass

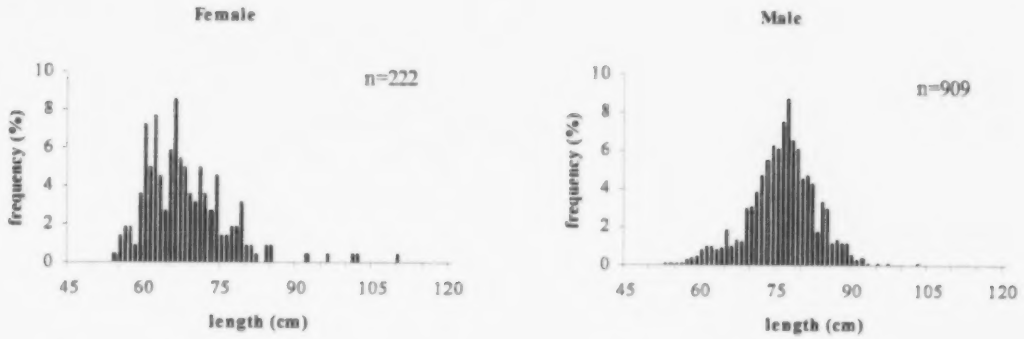
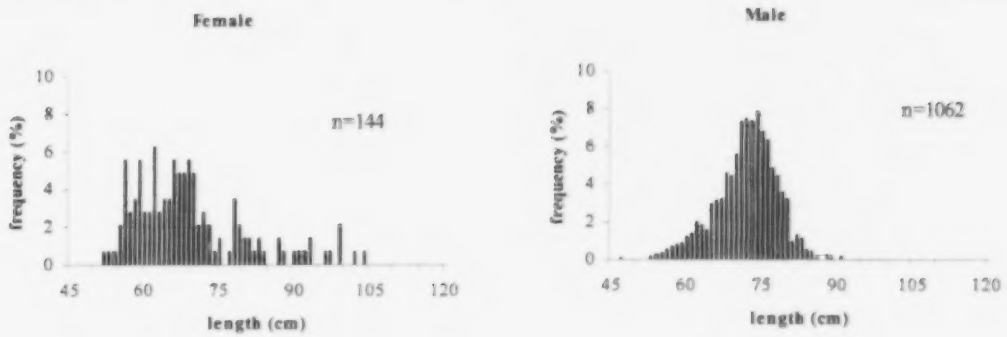


Figure 4 continued . Spiny dogfish length frequency by area from the Strait of Georgia October 18-31, 2005 longline survey.

Porlier Pass



Grants Reef

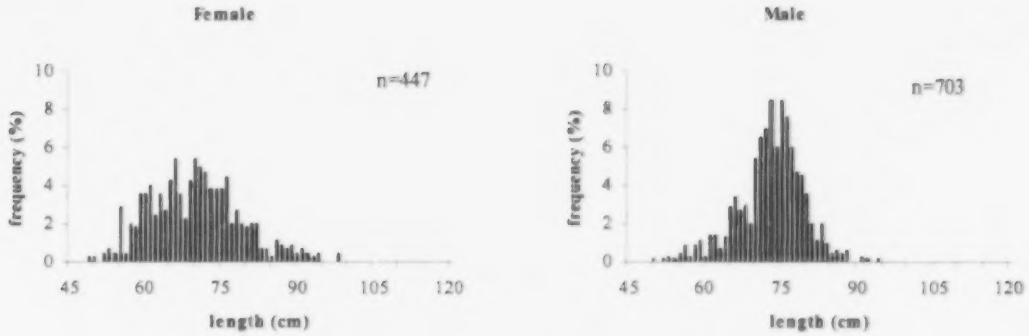


Figure 4 continued. Spiny dogfish length frequency by area from the Strait of Georgia October 18-31, 2005 longline survey.

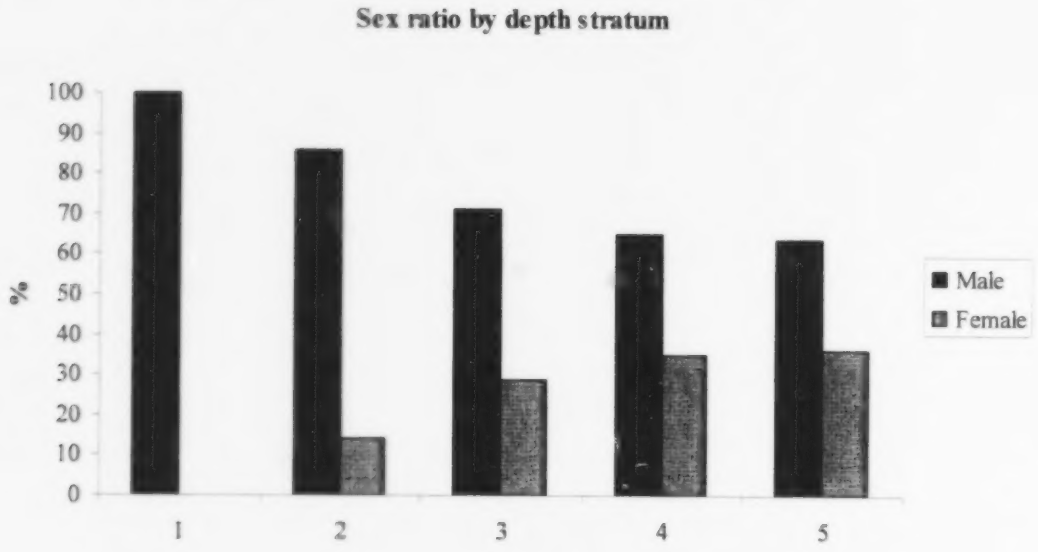


Figure 5. Spiny dogfish sex ratio by depth stratum from samples taken in the Strait of Georgia, October 2005 (1: 0 to 55m, 2: 56 to 110m, 3: 111 to 165m, 4: 166 to 220m and 5: deeper than 220m).

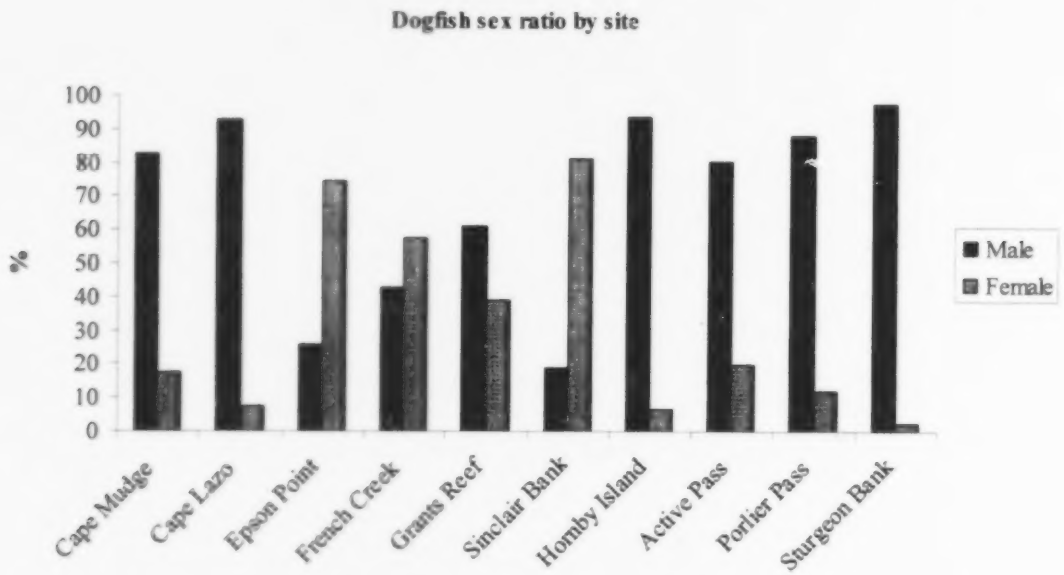


Figure 6. Spiny dogfish sex ratio by fishing site from samples taken in the Strait of Georgia, October 2005.

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Appendix 1. Description of maturity codes used during the spiny dogfish longline survey in October 2005.

Male		
Maturity Code	Description	Maturity Stage
10	Claspers do not extend past tips of anal fins; testes flat creamy	Immature
30	Claspers extend past tips of anal fins; not stiff; testes, even creamy coulour, not brown	Maturing
90	Claspers extend past tips of anal fins; stiff; testes, cramy-brown, bloodshot, very firm	Mature

Female			
Maturity Code	Ovaries	Uterii	Maturity Stage
10	Ova small, 0-5 mm diameter white firm ovary<1/4 length of body cavity	Thin no thickening	Immature
50	Ova 5-10mm, white firm, ovary flaccid, flocculent external surface	Thin no thickening	Immature
51	Ova 5-10mm, white firm, ovary flaccid, flocculent external surface	Thin, <5mm thickened section, <1/4 length of body cavity	Immature
53	Ova 5-10mm, white firm, ovary flaccid, flocculent external surface	About 5mm thickened section < 1/4 length of body cavity	Immature
55	Ova 5-10mm, white firm, ovary flaccid, flocculent external surface	Thickened section at least 10mm or wider, flaccid; >1/3 length of body cavity	Maturing
56	Ova 5-10mm, white firm, ovary flaccid, flocculent external surface	Encapsulated uterine eggs (candles)	Maturing
70	Ova yellow firm <30mm	Thin no thickening diameter	Maturing
71	Ova yellow firm <30mm	Thin, <5mm thickened section, <1/4 length of body cavity	Maturing
73	Ova yellow firm <30mm	About 5mm thickened section < 1/4 length of body cavity	Maturing
75	Ova yellow firm <30mm	Thickened section at least 10mm or wider, flaccid 1/3 length of body cavity	Maturing
77	Ova yellow firm <30mm	Yolk sac pups	Mature
78	Ova yellow firm <30mm	Term pups (no yolk sac)	Mature
79	Ova yellow firm <30mm	Flaccid	Mature
95	Ova white firm <10mm in diameter and yellow firm > 30mmin diameter; ovary flacid 1/3 length of body cavity	Thickened section at least 10mm or wider, flaccid; >1/3 length of body cavity	Mature
97	Ova white firm <10mm in diameter and yellow firm > 30mmin diameter; ovary flacid 1/3 length of body cavity	Yolk sac pups	Mature
99	Ova white firm <10mm in diameter and yellow firm > 30mmin diameter; ovary flacid 1/3 length of body cavity	Flaccid and empty	Mature

Appendix 2. Bridge log from the October 18-31, 2005 spiny dogfish longline survey aboard the *CCGS Neocaligus*. Effective fishing time in minutes; all depths in meters; latitude and longitude in decimal degrees; distance in nautical miles; vessel speed in knots; direction in degrees true.

Date	Location	Set number	Depth stratum	Number of hooks	Start latitude	Start longitude	End latitude	End longitude	Start time	End time	Effective Fishing Time	Direction	Distance travelled	Vessel speed	Start depth	Finish depth
19-Oct-05	Hornby Island	1	4	400	49.5581	124.5900	49.5776	124.6092	7:41	9:47	126	319	1.15	2.7	180	176
19-Oct-05	Hornby Island	2	3	449	49.5430	124.6072	49.5360	124.5859	8:59	11:03	124	117	1.25	2.7	130	152
19-Oct-05	Hornby Island	3	2	480	49.5523	124.6392	49.5418	124.6212	13:25	15:32	127	132	0.95	2.7	90	80
19-Oct-05	Hornby Island	4	1	500	49.5472	124.6423	49.5418	124.6212	14:29	16:30	121	118	0.845	2.7	45	35
20-Oct-05	Cape Lazo	5	5	492	49.7826	124.8371	49.7946	124.8516	7:30	9:33	123	120	0.92	2.5	230	235
20-Oct-05	Cape Lazo	6	4	508	49.7892	124.8579	49.8015	124.8758	8:30	10:40	130	317	1	2.6	183	183
20-Oct-05	Cape Lazo	7	3	500	49.7962	124.8794	49.7790	124.8620	12:24	14:32	128	137	1	2.6	157	157
20-Oct-05	Cape Lazo	8	2	500	49.7729	124.8991	49.7799	124.9214	13:17	15:32	135	294	0.95	2.5	74	74
21-Oct-05	Grants Reef	9	5	500	49.8073	124.7553	49.8206	124.7670	7:54	9:57	123	330	0.92	2.6	236	240
21-Oct-05	Grants Reef	10	3	500	49.8289	124.7308	49.8431	124.7379	8:48	11:00	132	342	0.9	2.6	158	151
21-Oct-05	Grants Reef	11	4	487	49.8142	124.7585	49.8205	124.7444	12:47	14:50	123	139	0.9	2.8	193	199
21-Oct-05	Grants Reef	12	2	500	49.8579	124.7535	49.8608	124.7791	13:57	16:00	123	280	1	2.8	75	62
22-Oct-05	Cape Mudge	13	5	500	49.9916	125.0817	50.0061	125.0942	7:25	9:28	123	334	0.97	2.6	63	97
22-Oct-05	Cape Mudge	14	4	500	49.9824	125.0935	49.9974	125.1000	8:50	10:55	125	344	0.93	2.7	192	190
22-Oct-05	Cape Mudge	15	2	500	49.9797	125.1101	49.9739	125.1317	12:43	14:49	126	247	0.9	2.6	246	258
22-Oct-05	Cape Mudge	16	3	500	49.9880	125.1015	49.9990	125.1175	14:08	16:12	124	317	0.9	2.7	159	140
23-Oct-05	Sinclair Bank	17	2	500	49.7050	124.2839	49.6937	124.2736	7:51	9:50	119	N/A	0.92	2.8	87	73
23-Oct-05	Sinclair Bank	18	3	500	49.7082	124.2924	49.7230	124.3003	9:18	11:22	124	341	0.94	2.8	119	142
23-Oct-05	Sinclair Bank	19	5	500	49.7168	124.3136	49.7040	124.3068	13:09	15:12	123	170	0.9	2.8	284	254
23-Oct-05	Sinclair Bank	20	4	500	49.7112	124.3051	49.7251	124.3121	14:22	16:24	122	342	0.87	2.7	202	198
24-Oct-05	Epson Point	21	4	500	49.4635	124.0222	49.4754	124.0430	7:22	9:24	122	311	1	2.8	182	182
24-Oct-05	Epson Point	22	3	500	49.4920	124.0523	49.5095	124.0660	8:51	10:58	127	333	1	2.8	150	152
24-Oct-05	Epson Point	23	2	500	49.5042	124.0520	49.4891	124.0357	12:45	14:48	123	160	1.1	2.9	80	68
24-Oct-05	Epson Point	24	5	500	49.4769	124.0528	49.4638	124.0357	14:18	16:22	124	140	1.1	2.8	230	241
27-Oct-05	Porlier Pass	25	5	400	49.0838	123.5972	49.0705	123.5832	8:32	10:32	120	145	0.9	2.8	229	227
27-Oct-05	Porlier Pass	26	3	400	49.0482	123.5869	49.0608	123.5977	9:47	11:49	122	331	0.9	2.8	134	110
27-Oct-05	Porlier Pass	27	4	400	49.0238	123.5336	49.0116	123.5139	13:31	15:49	138	133	0.95	2.8	191	188
27-Oct-05	Porlier Pass	28	2	400	48.9997	123.5443	48.9875	123.5256	14:43	16:44	121	135	0.9	2.8	92	60
28-Oct-05	Active Pass	29	4	400	48.9177	123.3246	48.9315	123.3386	8:39	10:38	179	326	0.95	2.9	185	190
28-Oct-05	Active Pass	30	5	385	48.9812	123.3902	48.9892	123.4126	9:41	11:58	137	299	0.95	2.8	255	273
28-Oct-05	Active Pass	31	3	400	48.9382	123.4055	48.9289	123.3845	13:34	15:37	123	124	0.95	2.8	160	130
28-Oct-05	Active Pass	32	2	400	48.9403	123.4220	48.9298	123.4035	14:36	16:35	119	131	0.95	2.8	104	80
30-Oct-05	Sturgeon Bank	33	2	400	49.1739	123.3060	49.1911	123.3059	7:05	9:05	120	0	0.9	2.8	102	98
30-Oct-05	Sturgeon Bank	34	3	400	49.1745	123.3281	49.1890	123.3238	8:09	10:15	126	14	0.9	2.8	153	160
30-Oct-05	Sturgeon Bank	35	4	400	49.1870	123.3461	49.2038	123.3399	11:28	13:38	130	14	1	2.8	189	189
30-Oct-05	Sturgeon Bank	36	5	400	49.2020	123.3743	49.1831	123.3812	13:12	15:30	138	194	1	2.8	240	251
31-Oct-05	French Creek	37	2	400	49.3563	124.3295	49.3489	124.3096	8:11	10:14	123	100	0.9	2.8	78	67
31-Oct-05	French Creek	38	4	400	49.3775	124.3277	49.3701	124.3091	9:01	11:16	135	122	0.9	2.8	208	190
31-Oct-05	French Creek	39	5	400	49.3850	124.3286	49.3867	124.3537	12:38	14:47	129	276	0.95	2.8	259	228
31-Oct-05	French Creek	40	3	400	49.3795	124.3470	49.3679	124.3295	13:17	15:35	138	135	0.9	2.8	145	116